ANESTHESIA IN DENTISTRY

Dr. Soukaina Ryalat

FFD oral and maxillofacial surgery/ Dublin

Head of oral surgery dept.,Jordan University

ANESTHESIA IN DENTISTRY

Dentistry is blamed for being a painful procedure . Relieving pain and dental phobia is one of the mandatory actions . Many procedures could not be done properly unless pain is well controlled ; ex. Fillings , extraction , periodontal procedures , root canal treatment , minor or major surgeries , etc.

➢ *Some important definitions*

- **Anesthesia : The loss or abolition of all modalities of sensations which includes :**
  Pain , touch , temperature , and pressure .

- **General anesthesia : Achieved when the patient becomes unconscious .**

- **Local anesthesia : The patient remain conscious but the anesthesia is localized to one part only .**

Anesthesia In Dentistry (contd…)

- **Infiltration anesthesia :** Deposit of solution in the region to be anesthetized and permeates through the tissue to affect fine nerve endings .

- **Block anesthesia :** To anesthetize a region by blocking the conduction in the nerve trunk supplying the area .

- **Topical or surface anesthesia :** Local anesthetic applied on an intact mucous membrane to anesthetize the nerve endings .

Anesthesia In Dentistry (contd…)

- **Paresthesia :** Altered sensation occurred when :

- A damaged sensory nerve is regenerating ;
- Local anesthetic action starting to work or wearing off ;
- Described as tingling sensation or pins and needles .

- **Relative analgesic :** A sedation technique in which the patient remains conscious but mental relaxation is induced by inhalation of a mixture of nitrous oxide , oxygen , and air . L.A. is used as adjacent when necessary .

- **Sedatives** : Produce sedation and relieve anxiety by acting on the CNS (e.g. Valium (Diazepam))

A – DESIRABLE PROPERTIES OF LOCAL ANESTHETICS ;

Local anesthesia has been defined as a loss of sensation in a circumscribed area of the body caused by depression of excitation in nerve endings or an inhibition of the conduction process in peripheral nerves.

There are many methods of inducing local anesthesia , some of which follow:

*** Mechanical trauma;**
*** Low temperature;**
*** Anoxia;**
*** Chemical irritants;**
*** Neurolytic agents such as alcohol and phenol;**
*** Chemical agents such as local anesthetics.**

A– Desirable properties of local anesthetics (contd…)

- The time of onset of anesthesia should be as short as possible;
- The duration of action must be long enough to permit completion of the procedure yet not so long as to require an extended recovery;
- It should have a potency sufficient to give complete anesthesia without the use of harmful concentrated solutions;
- It should be relatively free from producing allergic reactions;
- It should be stable in solution and readily undergo biotransformation in the body;
- It should either be sterile or be capable of being sterilized by heat without deterioration.

c) Electrophysiology of nerve conduction

- Peripheral nerves transmit electrical impulses to the brain;
- The generation of this electrical activity is governed by the distribution of ions across the nerve cell membrane;
- At rest , the nerve cell membrane is largely impermeable to *positively charged sodium;*
- The membrane is freely permeable to *Potassium*, this positively charged ion is maintained within the cell by the electronegative charge of the cell membrane;

Electrophysiology of nerve conduction (contd…)

-When the nerve is stimulated , ionic shifts occur leading to a degree of depolarization;

-When the stimulus is great enough to reduce the electronegative charge to around (- 55 mV), critical changes occur in the nerve cell membrane;

-This charge of - 55 mV is known as the Firing level;

- When the Firing level is reached, *the nerve cell membrane* becomes highly permeable to Sodium ions;

-Sodium rushes into the cell through the *" Sodium channel "*;

Electrophysiology of nerve conduction (contd…)

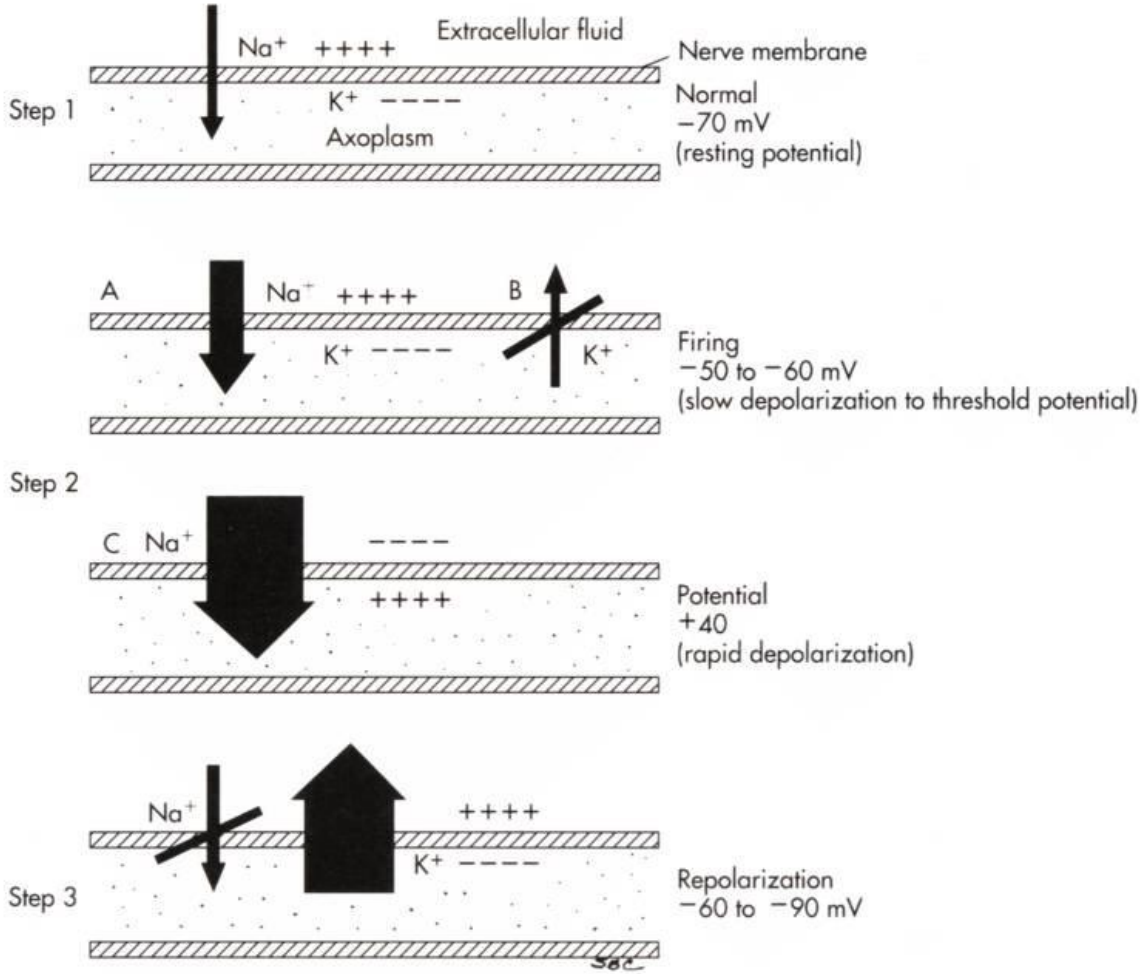
- This produces a *rapid depolarization* and the electrical potential across the nerve cell membrane is reversed to a level of around + 40 mV;

- This is the action potential which produces the electrical impulse.

- Following the generation of action potential, *re-polarization* to the resting level of - 70 mV occurs due to a *passive outward diffusion* of potassium;

- This imbalance (surplus of sodium inside the cell, extra-cellular excess of potassium) is corrected by an ATP-dependant sodium-potassium pump which actively transfers the ions across the membrane with the expenditure of energy.

Electrophysiology of nerve conduction (contd…)



Step 1 , **resting potential** . Step 2 , A & B , **slow depolarization to threshold** . Step 2 , c, **rapid depolarization** . Step 3 , **repolarization** .

Electrophysiology of nerve conduction (contd…)

In simple terms, local anesthetics act by preventing this entry of sodium ions and stopping propagation of electrical transmission by inhibiting nerve cell depolarization.

LOCAL ANESTHETIC

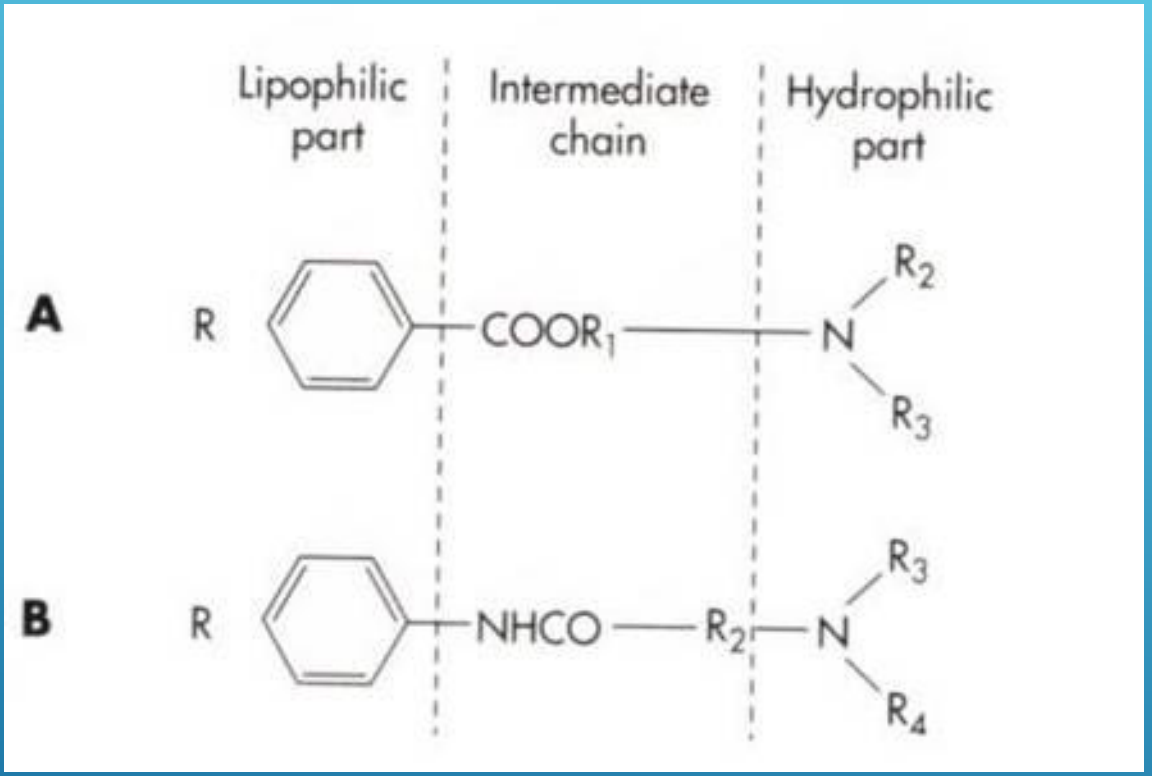
I – Classification of anesthetic agents :

- **Amides, Esters**, constitute the major categories of local anesthetics;
- The **Ketone-linkage** class of anesthesia has relatively little clinical importance and currently consists of a single topical agents.
- The **Lipophilic** part is the largest portion of the molecule. Aromatic in structure, it is derived from benzoic acid or aniline.
- The **Hydrophilic** part is an amino derivative of ethyl alcohol or acetic acid .

I – Classification of anesthetic agents (contd..)

- Local anesthetics without a hydrophilic part are not suited for injection but are good topical anesthetics (e.g., Benzocaine).
- The anesthetic structure is completed by an intermediate hydrocarbon chain containing either an ester or an amide linkage;
- Local anesthetics are classified as either Esters or Amides according to their chemical linkages;

I – Classification of anesthetic agents (contd..)



Typical local anesthetic . **A** , Ester type . **B ,** Amide type .

I – Classification of anesthetic agents (contd..)

- *As prepared in the laboratory, local anesthetics are basic compounds, poorly soluble in water, and unstable on exposure to air;*

- *However, being weakly basic, they combine readily with acids to form local anesthetic salts, in which form they are quite soluble in water and comparatively stable;*

- *Thus local anesthetics used for injection are dispensed as salts, most commonly the hydrochloride salt, dissolved in either sterile water or saline.*

II – Clinical Implications of pH and Local Anesthetic Activity

- ✓ The **PH** of the **L.A.** solution (and the **PH** of the tissue into which it is injected) greatly **influence** its **nerve-blocking action;**

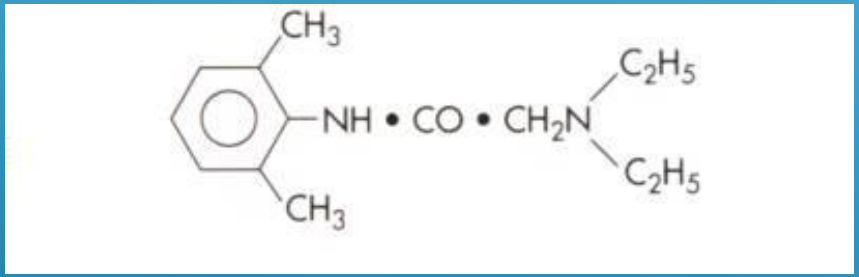
- ✓ **Acidification** of tissue **decrease L.A. effectiveness;** ***inadequate anesthesia*** results when **L.A.** are injected into **infected** or **inflamed** areas;

II – Clinical Implications of pH and Local Anesthetic Activity (contd…)

- ✓ Most solutions of local anesthetics without a vasoconstrictor have a pH between 5.5 and 7;
- ✓ Local anesthetic solutions that contain a vasopressor (e.g., Epinephrine) are acidified by the manufacturer to retard oxidation of the vasoconstrictor, thereby prolonging the period of the drug effectiveness.
- ✓ Sodium bisulfite is commonly used, in a concentration between 0.05 % and 0.1 %;
- ✓ A 2 % solution of Lidocaine, with a pH of 6.8, is acidified to 4.2 by the addition of *Sodium bisulfite.*

❖ lignocaine (*Xylocaine , Lidocaine*)

- Amide group ;
- Chemical formula : 2-Diethylamino 2', 6-acetoxylidide hydrochloride .



- Metabolized in the liver
- Excreted via the kidney 10% unchanged , 80% metabolites ;

❖ lignocaine (*Xylocaine , Lidocaine) (contd…)*

- Potency 2, toxicity 2, compared with Procaine;
- Vasodilator properties :
  - Less than Procaine
  - More than Prilocaine or Mepivacaine
- Possesses more rapid onset (2-3 minutes)
- Produce more profound anesthesia, has longer duration of action (half life 1.6 hours);
- Allergy virtually nonexistent;

lignocaine *(Xylocaine , Lidocaine) (contd…)*

- **Available** in three formulations :

  * 2% without V.C. (limited pulpal anesthesia) ;
  * 2% with V.C. (Epinephrine 1: 50.000) ;
  * 2% with V.C. (Epinephrine 1 : 80.000) ;

- Also available as : **4%** and **10% sprays , 2% gel , 5% ointment .**

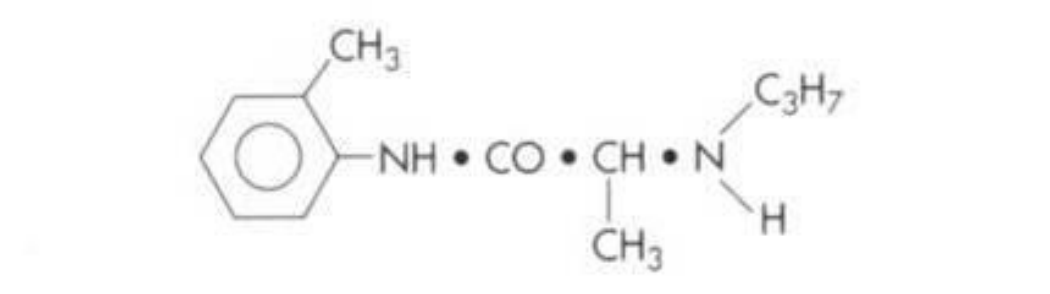
- **Provide pulpal anesthesia (45-60 minutes) ,**
- **Provide soft tissue anesthesia (3-5 hours) .**

- **Concentration 2% = 36 mg ;**

- **Maximum dose 4.4mg/Kg , around 300mg , maximum 8 cartridges .**

❖ Prilocaine (*Citanest*)

- Amide group
- Chemical formula : 2-Propylamino-o-propionotoluidide hydrochloride .



- Potency 2 , Toxicity 1 (40% less than Lidocaine)

Prilocaine ***(Citanest) (contd…)***

- Potency 2 , Toxicity 1 (40% less than Lidocaine)

- Metabolized in the liver into orthotoluidine and N-propylalanine , Prilocaine undergoes some bio-transformation in the lungs and kidneys ;

- Excretion occurs via the kidney in urine ;

- Prilocaine is as potent as Lidocaine ;
- Contraindicated in Sickle Cell anemias

- Plain solution is 4% prilocaine ;

- With vasoconstrictor 3% Prilocaine + 0.03 IU/ml Felypressin , (exist also with epinephrine) ;

Prilocaine *(Citanest) (contd…)*

- **The main use being in those cases where adrenaline is best avoided .**

- Slightly slower onset action than Lidocaine (around 4 minutes)

- **Maximum recommended dose : 4% = 72 mg , 6.0mg/Kg , around 400 mg , maximum 6 cartridges .**

- **4% Prilocaine ---------- pulpal anesthesia (10 minutes) ;**

- **3% Prilocaine + 0.03 IU/ml Felypressin , provides duration of anesthesia similar to Lidocaine with adrenaline :**
  - *** Pulp (60 minutes)**
  - *** Soft tissue (3-5 hours)**

Prilocaine *(Citanest) (contd…)*

- Felypressin has two systemic effects :

  - It can produce coronary artery vasoconstriction ,
  - It has an oxytocic action on the uterus .

  (normal dental doses , these effects are not apparent)

- Felypressin – containing L.A. provide poorer control of hemorrhage than Adrenaline- containing L.A. .

THE EQUIPMENT (ARMAMENTARIUM) FOR ADMINISTRATION OF LOCAL ANESTHETIC

- Syringes
- Needles
- Cartridges .

SYRINGES

The syringe consists of barrel and piston (plunger) attached to it from one end , and a needle adaptor (screw hub or convertible tip) on the other end to which the double-ended needle is fixed .

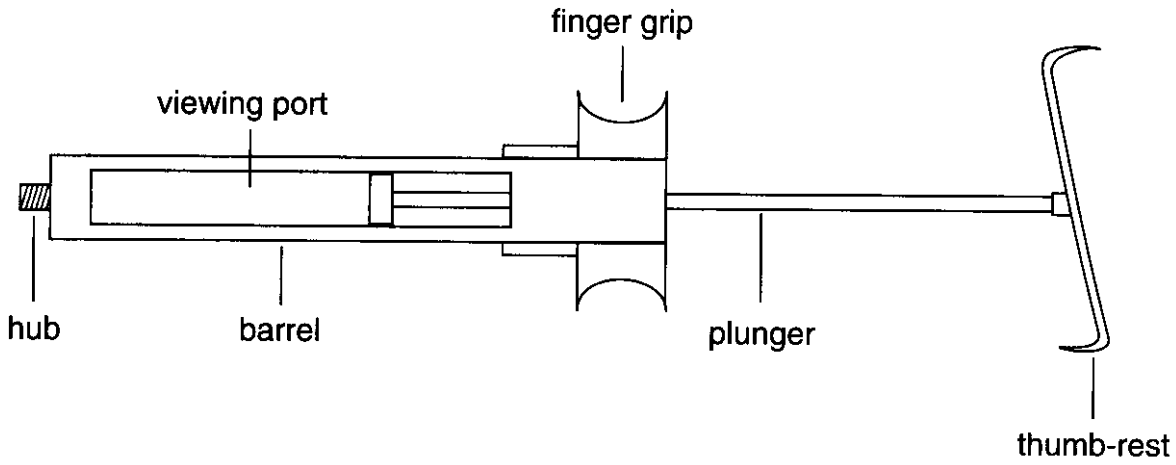


Fig. 4.12 The parts of a dental local anaesthetic cartridge syringe.

Types of the syringes

1- Non-disposable

A- Breech-loading cartridge syringe :

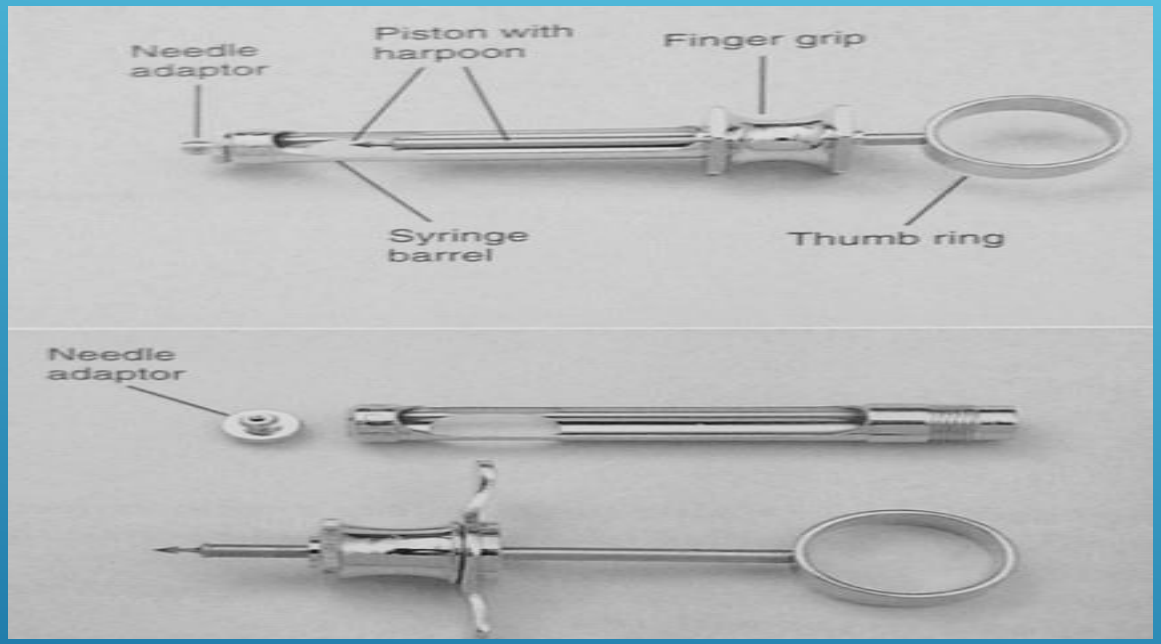
The term breech-loading implies that the cartridge is inserted into the barrel from the side .

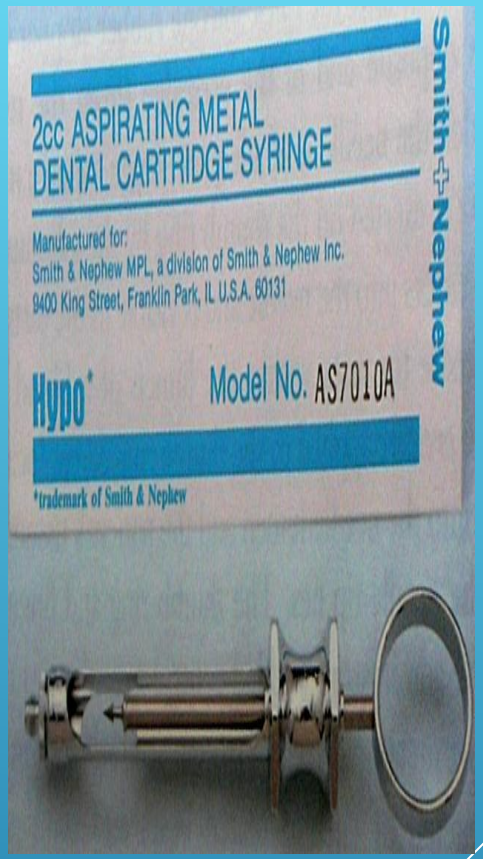
a- Breech-loading, metallic or plastic : cartridge-type ,aspirating ,

b- Breech-loading, metallic : cartridge-type, self-aspirating .

B- Top-loading cartridge syringe :

The cartridge is inserted into the barrel from the end opposite to the needle hub .





Breech loading, Metallic Dental Cartridge Syringe. Harpoon-type aspirating syring

Aspirating syringe type

The aspirating syringe has a device such as harpoon, which attached to the piston and is used to penetrate the thick stopper of the cartridge .

Positive pressure applied to the piston, force the local anesthetic into the needle lumen and into the patient's tissue . When negative pressure is exerted on the thumb ring, the blood will enter the needle lumen and become visible in the cartridge if the needle tip penetrate the blood vessel .

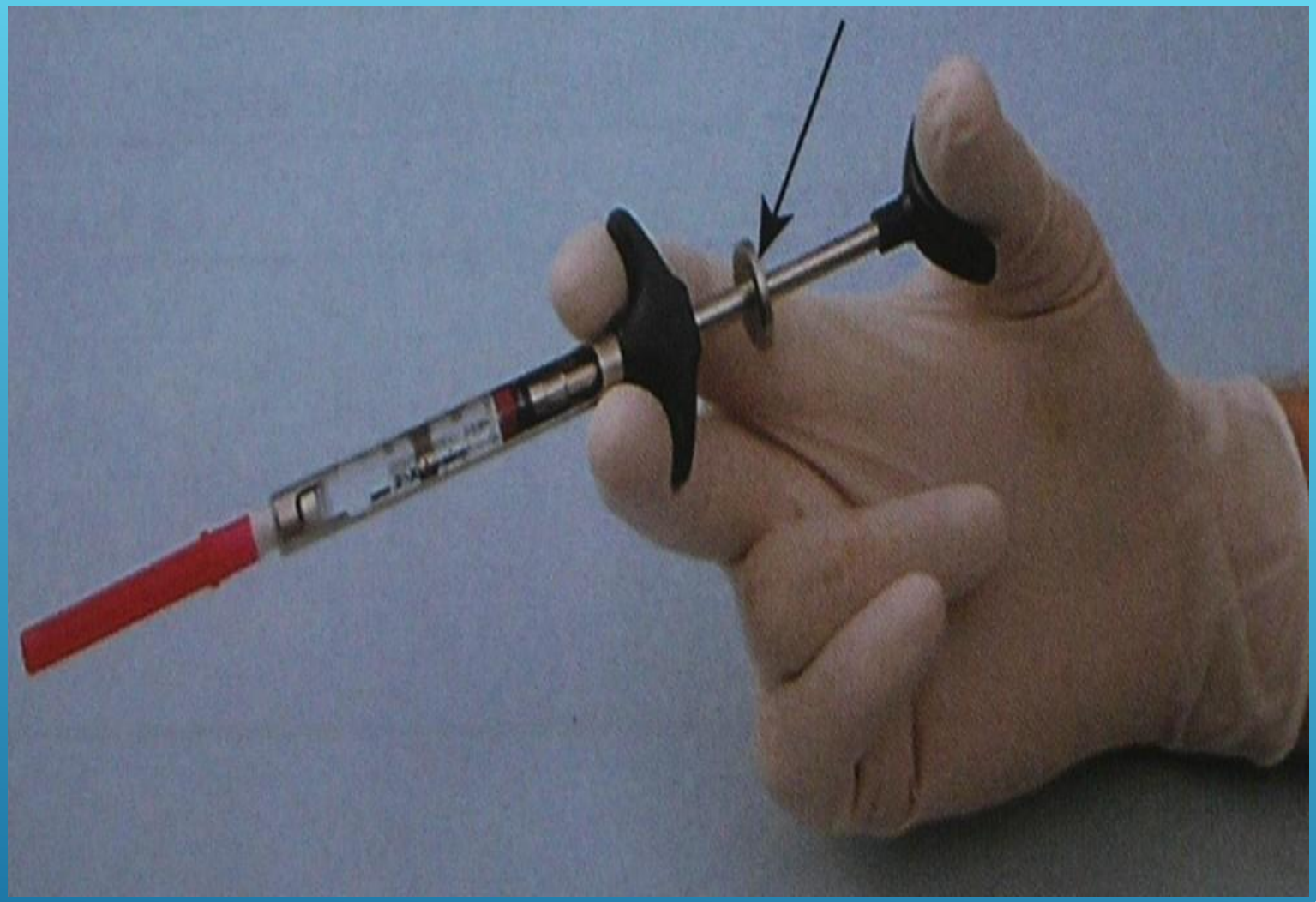
Self-aspirating syringes

These syringes use the elasticity of the rubber diaphragm in anesthetic cartridge to obtain the required negative pressure for aspiration .

The diaphragm rest on a metal projection inside the syringe that direct the needle into the cartridge .

When the pressure is released, sufficient negative pressure develops within the cartridge to permit aspiration .

Self-aspirating syringe and (arrow) the diaphragm of local anesthetic cartridge.



Pressure on the thumb disk (arrow) increases the pressure within the cartridge. Release of pressure on thumb disk produces self- aspirating test.

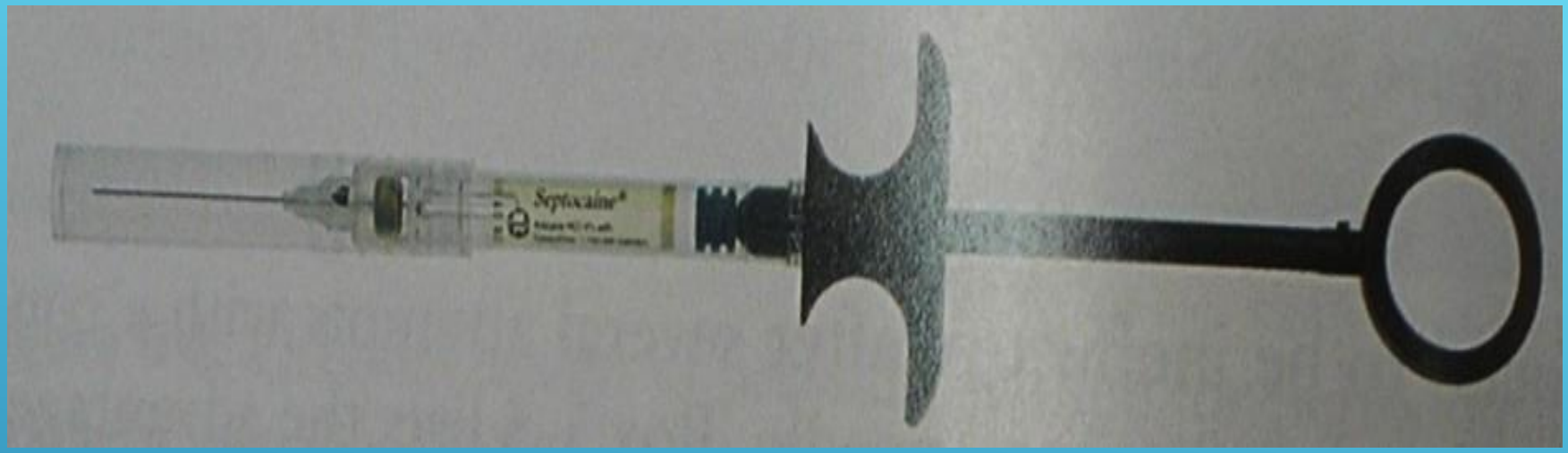
Pressure syringes

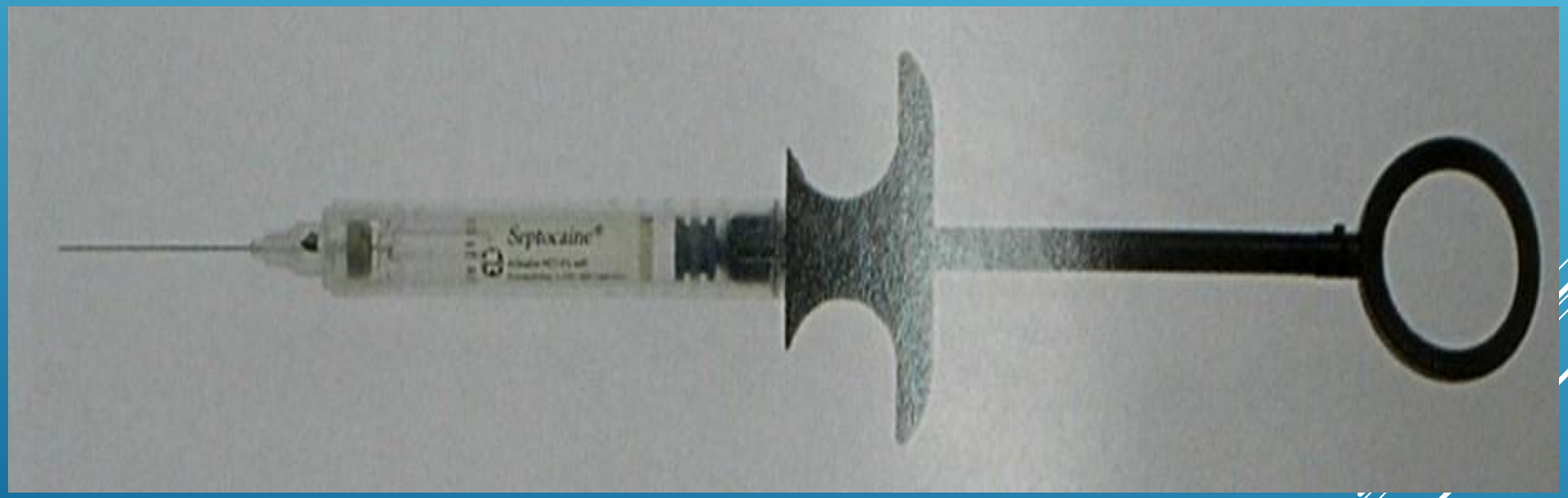
These types are completely enclose the glass cartridge, thereby protecting the patient from cartridge shatters .

They may be recommended for use only for PDL (periodontal ligament) injections after in effective injection by conventional one .

Attention ! Non-aspirating syringes are not acceptable because their use increase the risk of inadvertent intravascular drug administration .

2- Disposable syringes





UltraSafty Plus XL aspirating syringes (arrow)
Needle sheathed and needle ready for used

Most needles used in dentistry are stainless steel and are disposable .

The parts of the needle are :

*** Bevel , * shank , * hub , * syringe penetrating end .**

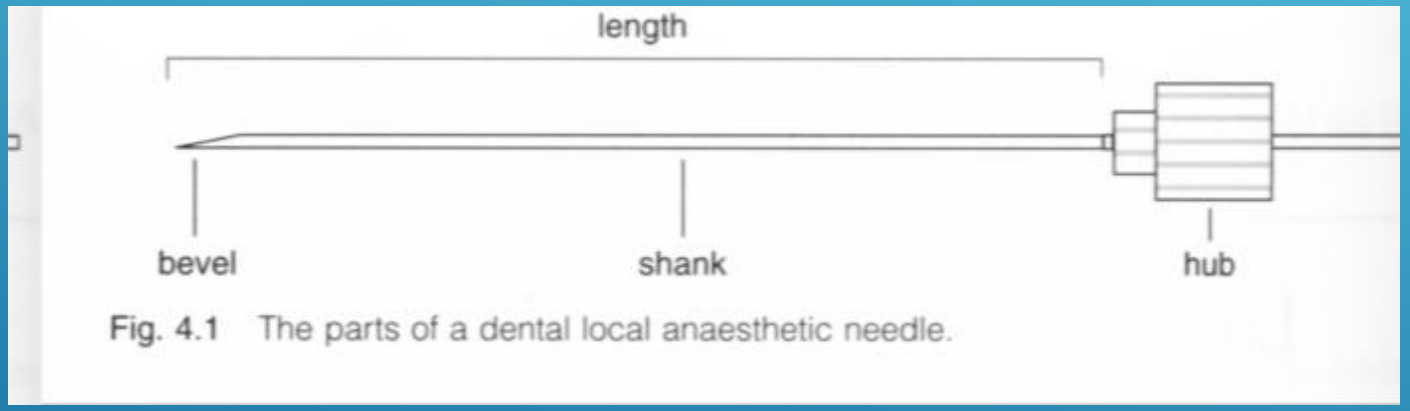
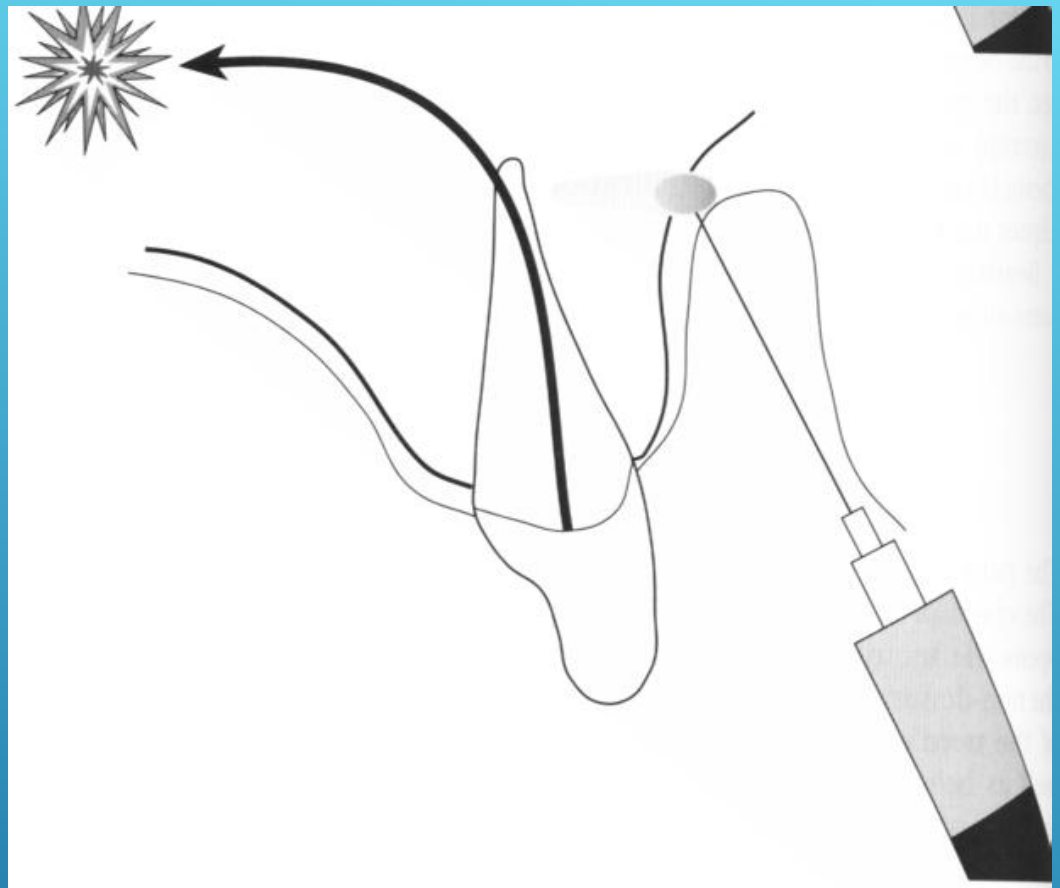


Fig. 4.1 The parts of a dental local anaesthetic needle.

NEEDLES



(a–c) Diagrammatic representation of infiltration anaesthesia in the maxilla.

MAXILLARY ANESTHESIA

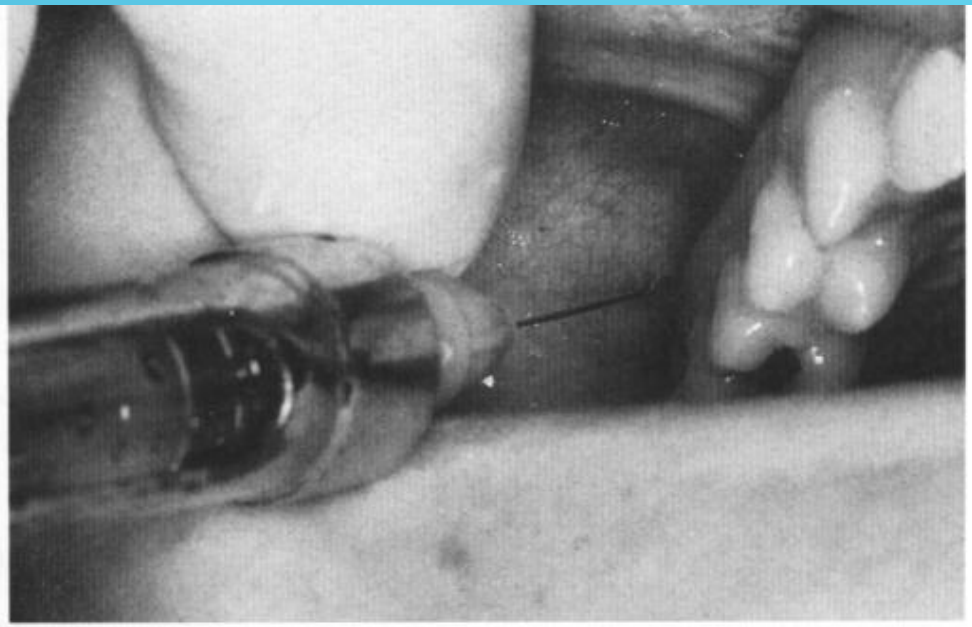


Fig. 7.6 Infiltration injection for a maxillary molar tooth. Note the needle is at an angle to the tooth in the anteroposterior plane.

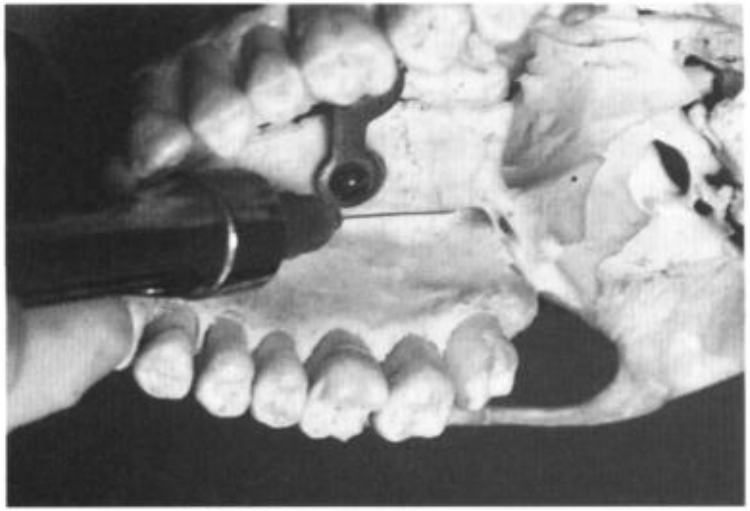


Fig. 7.9 Position of the needle for a greater palatine nerve block.

Fig. 7.10 Greater palatine nerve block injection.

GREATER PALATINE BLOCK ANESTHESIA

NASOPALATINE BLOCK ANESTHESIA

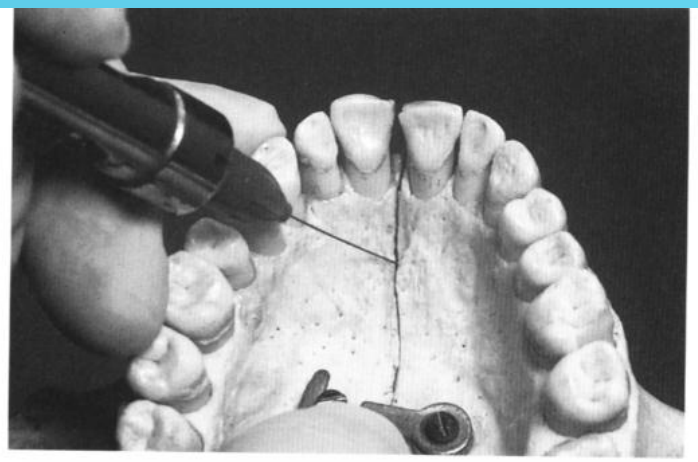


Fig. 7.14 Position of the needle for a nasopalatine nerve block.

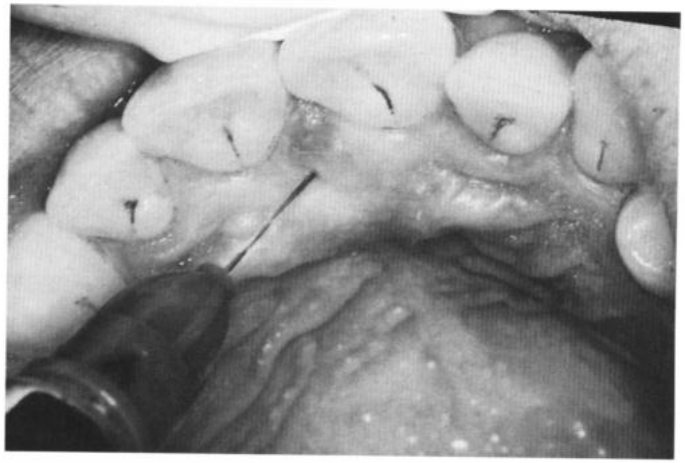
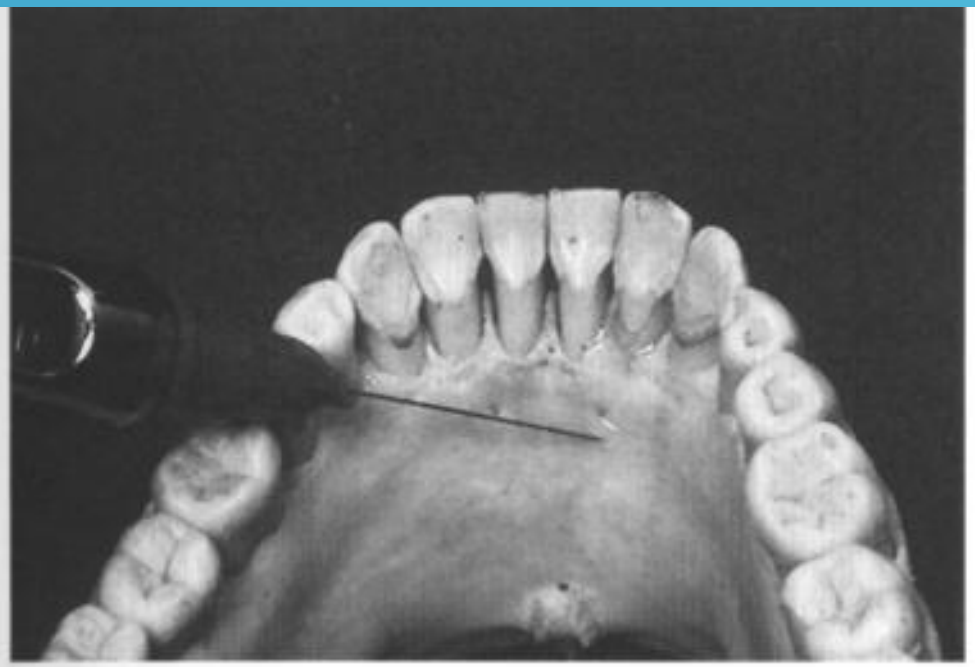


Fig. 7.15 Nasopalatine nerve block injection.

INFILTRATION IN MANDIBLE



(a)

Fig. 8.20(a,b) A lingual infiltration injection.

MENTAL BLOCK

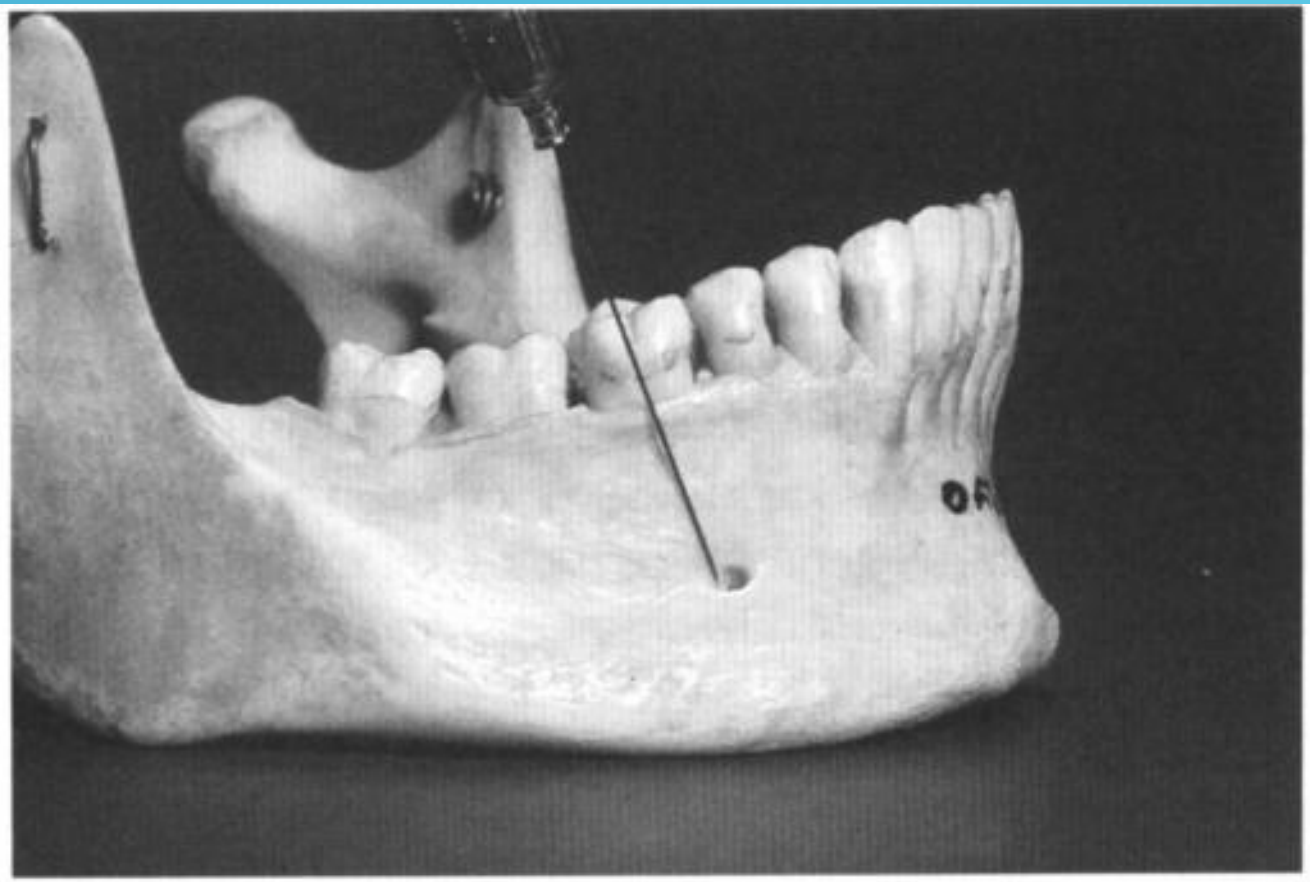


Fig. 8.13 The position of the needle for the incisive and mental nerve block injection.

INFERIOR ALVEOLAR BLOCK

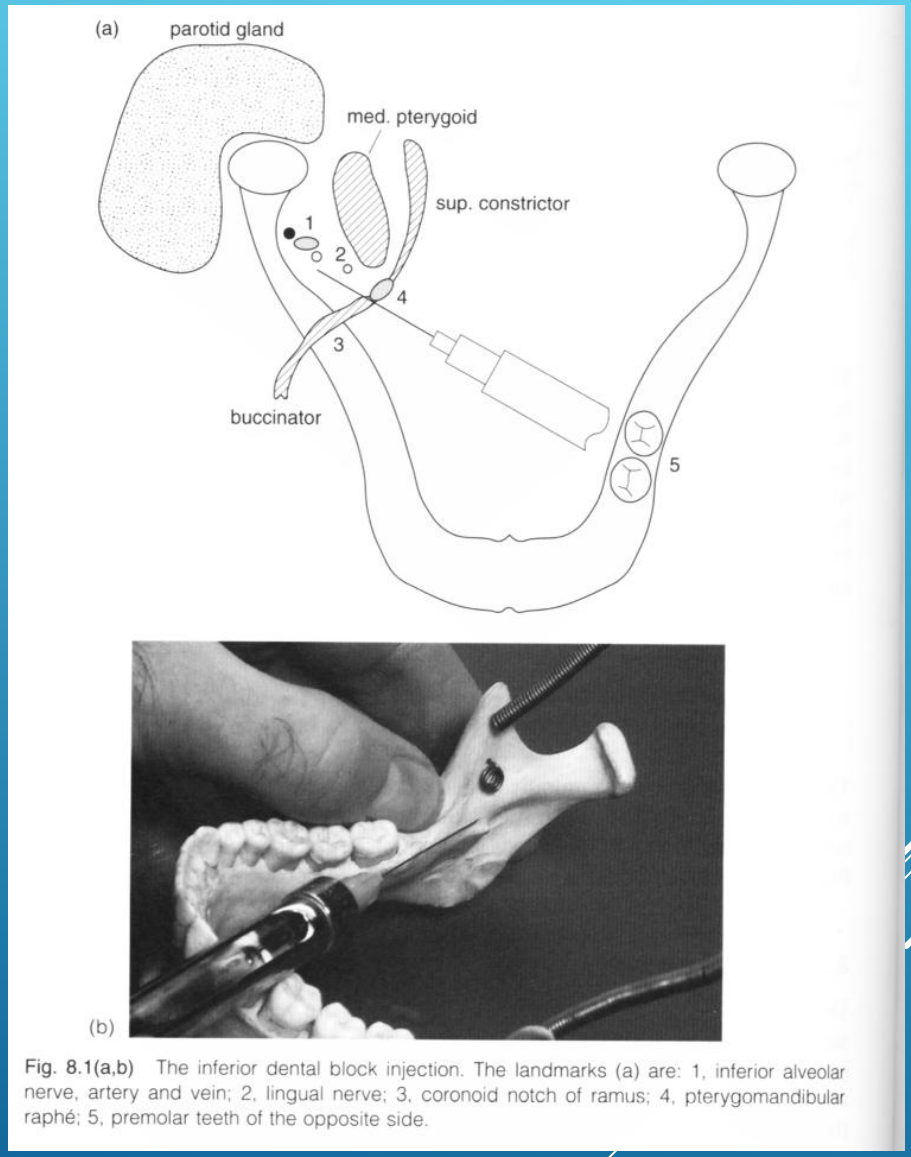


Fig. 8.1(a,b) The inferior dental block injection. The landmarks (a) are: 1, inferior alveolar nerve, artery and vein; 2, lingual nerve; 3, coronoid notch of ramus; 4, pterygomandibular raphé; 5, premolar teeth of the opposite side.

THE GOW-GATES METHOD

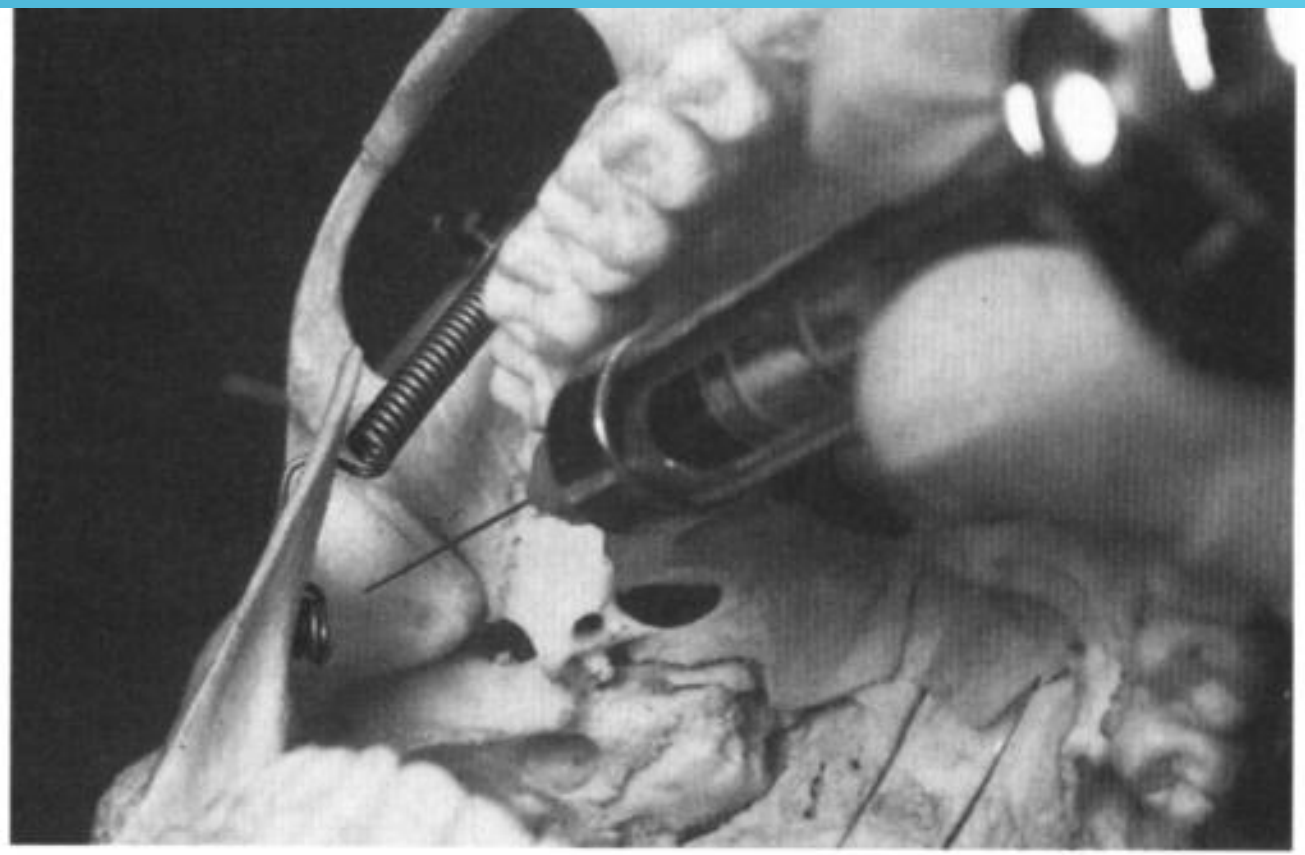


Fig. 8.8 The position of the needle at the head of the condyle during a Gow–Gates injection.

Extent of anesthesia with the Gow-Gate technique

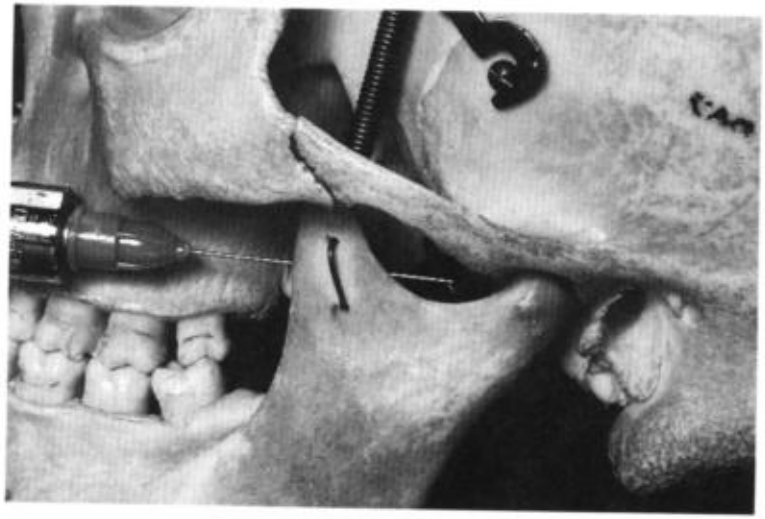
- All those supplied by the inferior alveolar nerve , lingual nerve , and long buccal nerve , also auriculotemporal nerve may be anesthetized

(b)

Fig. 8.9(a and b) The Gow–Gates approach to the inferior alveolar nerve block. The syringe is advanced parallel to a line connecting the corner of the mouth and the intertragic notch. The hub slides across the mesiopalatal cusp of the second maxillary molar.

THE AKINOSI METHOD

(a)



(b)

Fig. 8.12(a and b) The position of the needle during the Akinosi injection. The hub is advanced at the level of the mucogingival junction to the distal surface of the maxillary second molar tooth.

Extent of anesthesia with the Akinosi method

- This method anesthetizes the branches of the inferior alveolar nerve and lingual nerves ;
- The long buccal nerve supply may also be affected .

Referees

Dr. Paul Coulthard
Senior Lecturer and Honorary Consultant
Head of Oral and Maxillofacial Surgery
University of Manchester
Tel: 0161 275 665
paul.coultherd@manchester.ac.uk

Dr Richard Oliver
BDS BSc PhD FDSRCPS FDS(OS)RCPS
Senior Lecturer and Honorary Consultant in Oral Surgery
Undergraduate Coordinator for Oral & Maxillofacial Sciences
0161-275 6650
0161-275 6631 (Fax)
ritchard.j.oliver@manchester.ac.uk

THANK YOU